

## Claims

What is claimed is:

- Sub 1*
1. A method to optimize information retrieval based on communication relationships, comprising the steps of  
extracting and integrating relationship information from multiple heterogeneous information sources;  
building and storing a relationship data structure to represent the relationship information;  
and  
modifying a query based on the relationship data structure.
  - Sub 2*  
2. A method of claim 1, wherein said step of modifying a query comprises the steps of prioritizing and filtering the retrieval of related information.
  - Sub 3*  
3. A method of claim 1, wherein said step of modifying a query comprises the steps of augmenting information from the heterogeneous information sources.
  - Sub 4*  
4. A method of claim 1, wherein said step of modifying a query comprises the step of modifying a query to optimize delivery of query results.

5. A method of claim 1, wherein the heterogeneous information sources are selected from the group consisting of one or more of: people-managed data sources; organization charts; mailing lists; calendar entries; personal address books; priority lists of contacts; and automated system log type information including phone logs and e-mail logs.

6. A method of claim 1, further comprising the step of assigning different preferences to the heterogeneous information sources.

7. A method of claim 1, further comprising the steps of:

said step of building a data structure further comprising the step of tracking communication intensities between each pair of communication entities via each information source; and

integrating the relationship information from the heterogeneous information sources, in response to said tracking step.

8. A method of claim 7, further comprising the step of:

deriving a relation-group for each communication entity based on a pre-specified criterion on said communication intensities.

9. A method of claim 8, further comprising the step of:

selecting relation-group entities of a communication entity based on aggregate communication intensities to the communication entity.

10. A method of claim 9, further comprising the step of: computing an aggregate communication intensity from an entity A to an entity B based on a weighted sum of the communication intensities from said entity A to said entity B via each information source.

11. A method of claim 6, further comprising the steps of:

assigning a weight to each information source based on a preference; and  
computing the aggregate communication intensity, based on the weight and the preference.

12. A method of claim 8, further comprising the step of:

deriving relation-group entities of an entity allowing one or more of an indirect relationship and an inferred relationship.

13. A method of claim 12, further comprising the step of:

said deriving step further comprising the step of deriving a relation-group of an entity A, which can include the relation-group entities of an entity in the relation-group of the entity A.

14. A method of claim 8, further comprising the step of driving an awareness service based on a relation-group relationship.

15. A method of claim 7, further comprising the step of:

building and maintaining additional persistent data structures based on the results of the query to facilitate the response on future queries, based on the relationship data structure.

16. A method of claim 15 wherein the additional persistent data structure can be a personal address/phone book based on the communication intensity.

17. A method of claim 7, further comprising the step of determining a significance of a relationship between two entities.

18. A method of claim 17, further comprising the step of determining the significance of a relationship based on the aggregate communication intensity.

19. A method of claim 7, wherein the tracking step can be subject based.

20. A method of claim 8, wherein the relation-group can be subject based.

21. A method of claim 18, wherein the significance of the relationship can be subject based.

22. The method of claim 18, further comprising the step of downloading information based on the significance of the relationship.

23. The method of claim 3, further comprising the step of resolving name ambiguity by using the relationship from the heterogeneous information sources to determine one or more of an e-mail address, phone number, and a full name.

24. The method of claim 4, further comprising the step of recommending a communication channel based on a recipient characteristic.

25. The method of claim 7, further comprising the step of caching a document and information based on the significance of the relationship.

26. The method of claim 1, further comprising the step of detecting inconsistency among data in the heterogeneous information sources.

27. The method of claim 26, further comprising the step of detecting changes in the relationship information maintained.

28. The method of claim 27, further comprising the step of propagating the changes.

29. The method of claim 27, further comprising the step of alerting the changes.

30. A method of claim 1, further comprising the steps of:

integrating the relationship information from the multiple heterogeneous sources using a graph wherein each node represents a communication entity, and a link between a pair of nodes represents the existence of a communication relationship between the two nodes.

31. A method of claim 30, further comprising the step of labeling each link with a communication intensity vector, where each dimension of the communication intensity vector represents a communication intensity from an information source.

32. A method of claim 12, further comprising the step of calculating aggregate communication intensities taking into account the indirect relationship.

33. A method of claim 2, further comprising the step of prioritizing and filtering a list of name-to-e-mail address mappings to facilitate sending e-mail.

33. A method of claim 3, further comprising the step of obtaining relevant information from the heterogeneous information sources, said information selected from the group consisting of one or more of: phone numbers; e-mail addresses; mailing addresses; office location; department; or manager, from various information sources.

34. A method of claim 7, further comprising the step of calculating a communication intensity based on a number of communication events.

35. A method of claim 7, further comprising the step of calculating a communication intensity based on both a number of communication events and their temporal characteristics.

36. A method of claim 7, further comprising the step of calculating a communication intensity based on an analysis of a content of a communication event.

37. A method of claim 3, further comprising the step of modifying the query to create one or more sub-queries.

38. A method of claim 37, further comprising the step of aggregating results from the sub-queries.

39. A method of claim 37, further comprising the step of excluding results from the sub-queries

Sub B2

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extracting and integrating relationship information from multiple heterogeneous

building and storing a data structure to represent the relationship information; and

modifying a query based on the relationship data structure.

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